

Some Experiments made in the Air pump upon Plants, together with a way of taking exhausted Receivers away from off the said Engin : Tried by the same Persons mention'd in Numb. 119. viz. Monsieur Hugen and M. Papin.

I Took one day a small Recipient shaped like that, described formerly *, and instead of an Iron wire, I passed into the little hole a sprig of a known Plant, which was * See Numb. 119. P. 443. *Baulme*, so as that the Top of the plant was within the Recipient, and the Roots without. Then I closed the rest of the hole with cement, that so I might keep it void a good while : But because I was not willing, that it should embarrass the Engin, 'twas necessary to find a means of taking it away when exhausted. For that purpose I used the following method, which is very sure and very commodious, and which hath served me for many other Experiments hereafter to be related.

The method was this: I caused the edges of the wide Orifice of my Recipient to be well ground, so as that being applyed, it every where touched the Glass-plate, which had also been very smoothly ground to serve for a cover to the same; and I spread a piece of Lambskin wetted over the said plate, and having thus applyed it to the Engin, I put my Recipient over it : But in one place there was a Hail-shot of lead, which kept the Receiver from being exactly applied to its cover, that so the Air might more freely get out. And having afterwards whelmed another great Receiver over all, I caused the Pump to be plyed. All being well evacuated, I shook the Engin so as that the little Receiver fell off from the Hail-shot, and stood every where close to the skin, expanded over the cover of the Glass-plate. Then I had no more to do but to suffer the Air to re-enter into the great Receiver, and this Air pressing upon the little one, kept it so closely fasten'd to its cover, that it was impossible for me to sever them. And I am assured, that the Air enters not into the small Receiver, when 'tis thus applyed upon the skin; for I have often put *Gages* in them, which alwaies kept at the same height, although the Air was permitted to repass into the great Receiver. You might also let alone the putting under of the Hail-shot to keep up the little Re-

cient, because the Air by its Spring would lift it up sufficiently ; but then the *vacuum* would not be so perfectly made.

When I had thus taken away my little emptied Receiver, with the Plant, half sh it up therein ; I put the whole into a great Glass filled with water, the Root being downwards ; and I saw, that there were formed little water-drops upon the leaves that were in *vacuo*. I left it ten daies in this condition, and during that time there was entred about two spoonfuls of water in the Receiver, and in all appearance this water had pressed through the Plant. Yet there appear'd no more any drops upon the leaves ; but that might very well come from the grosser excrementitious matter that is in the water, which had stopp'd the Conduits.

After this, to know whether any Air had been form'd there, I replaced the Receiver upon the Engin, and having whelmed a bigger over it, I saw there was but very little Air form'd in the small one, because the great Recipient was almost all empty before the Air included in the little one could lift it up. Yet at last it did raise it, and I enclined the Engin, to the end that the little Receiver might not be applied to its cover when I should let the Air re-enter ; and after this manner both the Recipients were filled in the same time. Then I looked upon the leaves of the Plant. They were not withered, though they were not grown ; only the leaves had in the middle a little changed their colour, and had a smell somewhat sowerish ; but the next morning the plant was quite spoiled. We may believe that the pressure of the Air had made the water enter into this plant with so great a violence, that thereby it had, as 'twere, mortified the parts, especially in the middle where the leaves were most tender ; but this water still kept the leaves extended, and so they withered not ; but, when the Air came to act upon them, the parts of the Plant that had so much suffer'd were soon corrupted by it. For 'tis very probable, as well by this Experiment, as by others hereafter to be mention'd, that the Air is a Dissolvent which corrup-

* See the Micrographia
Obst. 16.

This being done, I made the Experiment the other way, that is, with the Leaves *in the Air*, and the Roots in a bottle of water that was in *vacuo* ; and immediately I saw Air-bubbles issuing out at the end of the tail in *vacuo*. After

ter this, I put water upon the leaves, to see whether this Air came from thence, and I saw indeed soon after, that these bubbles began to cease; and having taken away the water wherein the leaves were, I saw that the bubbles began again to issue out at the tail as before: And I saw them *still* come out 24 hours after, but in little quantity; and at length they quite ceased. During these 24 hours the Roots did lengthen about four lines, that is, one third of an Inch; which is a little less than they ordinarily do in the Air.

I kept the Plant in this condition for four daies upon the Engin, and took care from time to time to draw out the Air that entred into it by the leaves; and then it began to wither, and the Roots shot no more.

Another time I put two twigs of *Baulme*, each into a Vial full of water, and at the end of five daies, when I saw manifestly that they both shot Roots, I included in the *vacuum* that of the two which had the longest roots, without taking it out of its Vial. At the end of three daies, observing that it was wither'd in *vacuo*, I took it out, and changed the Vials of the twiggs, to see, whether that which had remain'd *in the Air*, and did thrive very well in common water, would also thrive in water freed of Air; and whether that which was wither'd in *vacuo*, would revive in the common water and in Air. Four days after I found the twigg that had been in *vacuo* quite spoiled, and the other still verdant, but not thriving; and I observ'd, that it did not begin to shoot in the water freed of Air till ten daies after it had been put in.

This Experiment drew another after it, to know, whether the water purged of Air were less fit than common water to make plants vegetate. For this end I took two Vials full, the one of water purged, the other of common water, and having put a twigg of *Baulme* in each, I left them both in the Air. I found, that the twigg in the common water shot at the end of six daies, and in water purged shot this time neither but ten daies after it had been put in.

I repeated this Experiment once more, and I was much surprized to see, that the twigg in the water freed of Air begun this time to shoot the third day, and the other in the common water, still the sixth day. But this was remarkable herein, that the twigg in the

the water purged shot not more but one root which grew very long, and on the ninth day only it began a little to shoot another, which lengthen'd but one line in two daies, whereas the twigg in the common water had then nine or ten roots, which were all very long, having alwaies lengthen'd five lines or more in a day.

Although this Experiment appear'd at first contrary to the precedent, yet it still confirmed the first thought, to wit, that the Air which is mixed in common water serves for vegetation, considering the little root which the twigg shot in the water cleansed of Air. Meantime I do not believe, it will be easie to know the particular reason, which made the first root shoot so soon.

After this, I made some Experiments upon *harder* Plants. One day I put a green piece of *Sallow*-wood, part in the Air and part in *vacuo*, after the manner above described. I put into water that part which was in the Air, and the water presently began to mount and to pass through the middle of the wood, and unceasingly form'd bubbles in the Receiver. These bubbles continued thus for the space of 24 hours; and certainly it was the water, which passing thorow the wood was in part changed into Air. For, I made the same Experiment with a piece of *Buffe*, and the water mounted also and passed through it, but it formed no bubbles. Meantime, if there be *Valves* in wood, they must needs be unable to resist the pressure of the Air; for I have noted in *Sallow*, as well as in *Elm*, that the water passes through them with the same facility what end soever you put in *vacuo*.

One day also I put the upper end of a little *Elm*-branch in the *vacuum*, and the lower end in the Air. This lower end I drenched in water, as I had done the Roots of *Baulme* in the first of these Experiments: But it was a whole hour before there appear'd any drop of water upon the *Elm*-leaves in *vacuo*, whereas upon the *Baulme*-leaves the drops appear'd presently. The cause of which may be the hardness of *Elm*-wood. But I know not, why water passing through *wood* forms bubbles, and in passing through *leaves* forms nothing but drops.

I made also the Experiment the other way, that is, the Leaves in the water without the Recipient, and the lower end of the branch in *vacuo*, and I saw, that there passed nothing for two hours time;
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infomuch that I cut a little of the upper end of the branch which was very tender, and then indeed I saw a little moisture appear at the end that was in *vacuo*, but that enough only to form one drop; and there appear'd no bubble of Air. Then I cut the branch yet a little lower, and then there was form'd one drop of water at the end that was in *vacuo*, but it fell not. And having cut the branch yet a little more, the drop of water fell down in *vacuo*. This shews, that they were not the *valves* of the plant that hindered the water from passing whilst the branch was entire; but rather that it was the great tenderness of the leaves, suffering themselves to be compress'd by the pressure of the Air, and that so the water could not insinuate it self between their parts.

An Account of some Books:

1. *Francisci Willughbeii de Middleton Armigeri, è Reg. Societate, ORNITHOLOGICÆ Libri tres; in quibus Aves omnes hætenus cognita, in methodum naturis suis convenientem redacta, accuratè describuntur; Descriptiones Iconibus elegantissimis & Vivarum Avium simillimis, aeri incis, illustrantur: Totum opus recognovit, digessit, supplevit Joh. Rajus, pariter è Soc. R. Sumptus in Chalcographos fecit Illustriss. D. EMMA WILLUGHBY, vidua. Londini, Impensis Joh. Martyn, Typographi Soc. Regiæ, ad insigne Campanæ in Cæmeterio D. Pauli, 1676, in fol.*

AS the person, that hath review'd, methodized and supplied this Work, Mr. *John Ray*, hath given to the worthy and learned Author thereof his just Elogy in the Preface; so we cannot but very thankfully acknowledge not only the Industry, Care and Accuracy of the said person in digesting and perfecting it, but also the Bounty of that Excellent Lady, the Authors Relict Widow, enriching the same with so vast a Number of Elegant and Costly Figures; whereby She hath indeed immortalised Herself as well as her Deserving Consort, and manifested to the World, that in a time when many stain their lives by unworthy pleasures, she knew how to adorn hers by the exercise of Ingenuity and Virtue: In the doing of which, as she hath put a lustre upon herself, that makes her outshine many of her Sex; so she hath raised in Us very great hopes, that she will continue the same nobleness in the publication of the rest of the *History of Animals*, mention'd in the Preface.

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